

MiniDungeons 2

An Experimental Game for Capturing and Modeling Player Decisions

Christoffer Holmgård
IT University of Copenhagen
holmgard@itu.dk

Julian Togelius
New York University
julian@togelius.com

Antonios Liapis
University of Malta
antonios.liapis@um.edu.mt

Georgios N. Yannakakis
University of Malta
georgios.yannakakis@um.edu.mt

ABSTRACT

This paper describes *MiniDungeons 2* (MD2): a turn-based rogue-like game developed to support research in capturing and modeling player decision making processes through *procedural personas* and using such models as critics for procedural content generation. MD2 intends to provide a full-circle framework for collecting, modeling, simulating, and producing content for player decision making styles.

The fully instrumented and telemetric game will soon be made available to the public to be played on smart-phones for the purpose of collecting as many play traces, representing as many different decision making styles, as possible.

1. MOTIVATION

A common characteristic of good games is that they offer players the opportunity to make interesting choices [3]. Psychology and game analytics [1, 9] suggest that players exhibit diversity in their decision making preferences in general and when playing games, due to aesthetic preferences or due to differences in how players apply bounded rationality in their decision making [4, 6]. Describing, characterizing, modeling, and simulating player decision making styles may be useful for game design purposes, whether for informing game designers [1] or for shaping procedural content generation processes [8].

As a next step toward our research goal of modeling player decision making via procedural personas [5], we present *MiniDungeons 2* (MD2), a game specifically designed and implemented to support research into player decision making. MD2 represents an iteration from its predecessor, *MiniDungeons* [5], and is designed from six pragmatic design goals identified from working with the first *MiniDungeons* game:

Accessibility: MD2 is playable on smart-phones as well as in web browsers in order to reach as many potential players as possible and requires little to no manual skill to play.

It is inspired by simple yet deep tactical smart phone games such as *Hoplite* [2].

Decision Density: every decision the player makes in MD2 has a significant and salient impact on the game state meaning that every decision counts.

Decision Diversity: levels included in MD2 may be solved in many different ways, in an attempt to support variety in decision making preferences.

Decision Complexity: a complete game tree for a single level of MD2 is difficult to simulate mentally, enticing players to conduct some aspects of decision making through analytic thinking and other aspects through heuristic thinking [7].

Automatability: Full play traces from MD2 are collected automatically, the game contains hooks for implementing game playing AI agents, and is open to the procedural content generation of levels.

The intent of these six design goals is to create an easily accessible framework that allows for full-circle collection, modeling, simulation, and designing for decision making styles in one unified game. Once we have substantiated that MD2 lives up to these design goals we hope to offer the game to the community as a tool for player decision research.

2. MINIDUNGEONS 2 GAME PLAY

MD2 is themed as a single-player dungeon-crawling game. Game play is turn-based and takes place on 10 by 20 tile-based levels where tiles are either *Walls* or *Passable Tiles*. Walls are completely impassable. Passable Tiles may contain objects and/or game play characters, i.e. the player-controlled Hero or computer-controlled characters (NPCs). Objects include Treasures, Potions, Traps, Portals, one Entrance, and one Exit. The level ends when the Hero reaches the Exit or when the Hero dies. Game play characters may move between empty tiles by moving either North, East, South, or West. All game play characters have hit points (HP) and can deal damage. Objects have different properties:

Treasures when reached are consumed by the Hero, increasing the player's treasure score. Treasures may also be consumed by Ogres.

Potions when reached are consumed by the Hero, increasing the Hero's HP by 1, to a maximum of 10 HP. Potions may also be consumed by Blobs.

Traps deal 1 damage to any character that moves into them.

Portals come in pairs: a character moving into a portal

is immediately (on the same turn) teleported to the linked portal.

The Entrance and the Exit determine where the Hero starts and where the Hero must go to complete the level.

The player controls the *Hero* of the game and always moves first, upon which each object and character in the level in sequence respond deterministically. The Hero starts each level with 1-10 HP. The Hero possesses a single *Javelin* which can be thrown at any other character to which the Hero has an unbroken line of sight. The Hero deals 1 damage to other characters on collision or by throwing the Javelin at them. The Javelin remains on the tile to which it was thrown, and the Hero must go there to collect it. NPCs then respond to the player's decision:

Goblins move 1 step toward the Hero along the shortest path if they have an unbroken line of sight to the Hero. They have 1 HP and deal 1 damage on collision. Goblins avoid colliding with other Goblins or Goblin Wizards.

Goblin Wizards deal 1 ranged damage to the Hero, if they have an unbroken line of sight and are within 5 tiles of the Hero; otherwise, they move 1 step toward the Hero. Goblin Wizards have 1 HP and deal no damage on collision.

Blobs remain static unless they have an unbroken line of sight to either the Hero or a Potion. If a Blob sees either, it moves 1 tile toward the closest one, preferring Potions over the Hero. When Blobs collide with each other, they merge into a larger, more powerful Blob. The simplest Blob has 1 HP and deals 1 damage to a colliding non-Blob character; this upgrades to 2 HP and 2 damage, and 3 HP and 3 damage at maximum power. A more powerful Blob which receives damage loses one power level.

Ogres remain static unless they have an unbroken line of sight to either the Hero or a Treasure. If an Ogre sees either, it moves 1 tile towards the closest one, preferring Treasures over the Hero. If the Ogre reaches a Treasure it consumes the Treasure and becomes fancier to look at. Ogres have 2 HP and deal 2 damage to any other character they collide with, including other Ogres.

Minitaurs always move 1 step toward the player along the shortest path as determined by A* path-finding, disregarding other characters and objects. Collision with a Minitaur deals 1 damage to the colliding character. A Minitaur does not have HP and does not die, but will be knocked out for 3 rounds if it receives damage.

3. DISCUSSION

The characters and objects in MD2 have simple properties, and respond deterministically to the player's decisions. In combination they interact to create interesting game play that we hope players will enjoy. The complexity of game play in MD2 depends on the individual level and is arguably intractable to compute since each level has many different solutions depending on the player's decision making preferences. Still some estimates can be provided on a per level basis: The level displayed in Fig. 1 contains 105 tiles which the Hero may occupy. Across these tiles 240 moves are possible and, in the start configuration, 118 of these tiles allow the Hero to throw the Javelin. On average this corresponds to an estimated branching factor of 3.41 per state though the actual number may differ based on play style. We expect players to rely on analytic and heuristic problem solving to various extents and in various ways, allowing us to observe and model decision making styles.



Figure 1: A typical MiniDungeons 2 level at start (left panel) and after three turns (right panel).

4. ACKNOWLEDGEMENTS

The research was supported, in part, by the FP7 ICT project C2Learn (project no: 318480) and by the FP7 Marie Curie CIG project AutoGameDesign (project no: 630665).

5. REFERENCES

- [1] A. Canossa and A. Drachen. Patterns of Play: Play-Personas in User-Centred Game Development. In *Proceedings of the 2009 DiGRA International Conference*, 2009.
- [2] D. Cowley, G. Te, M. Mcfarland, and A. Tyler. *Hoplite*. Magma Fortress, 2013.
- [3] G. S. Elias, R. Garfield, and K. R. Gutschera. *Characteristics of Games*. MIT Press, 2012.
- [4] G. Gigerenzer and W. Gaissmaier. Heuristic Decision Making. *Annual Review of Psychology*, 62:451–482, 2011.
- [5] C. Holmgård, A. Liapis, J. Togelius, and G. N. Yannakakis. Evolving Personas for Player Decision Modeling. In *IEEE Conference on Computational Intelligence and Games*, 2014.
- [6] D. Kahneman. Maps of Bounded Rationality: Psychology for Behavioral Economics. *American Economic Review*, pages 1449–1475, 2003.
- [7] D. Kahneman. *Thinking, Fast and Slow*. Farrar, Straus and Giroux, 2011.
- [8] A. Liapis, C. Holmgård, G. N. Yannakakis, and J. Togelius. Procedural Personas as Critics for Dungeon Generation. In *Proceedings of Applications of Evolutionary Computation*, 2015.
- [9] P. Thunholm. Decision-Making Style: Habit, Style or Both? *Personality and Individual Differences*, 36(4):931–944, 2004.